METHODS, SYSTEMS, AND COMPUTER PROGRAM PRODUCTS FOR PARALLEL CORRELATION AND APPLICATIONS THEREOF

ABSTRACT OF THE DISCLOSURE

A fast correlator transform (FCT) algorithm and methods and systems for implementing same, correlate an encoded data word (X_0-X_{M-1}) with encoding coefficients (C_0-C_{M-1}), wherein each of (X_0-X_{M-1}) is represented by one or more bits and each said coefficient is represented by one or more bits, wherein each coefficient has k possible states, and wherein M is greater than 1. X_0 is multiplied by each state ($C_{0(0)}$ through $C_{0(k-1)}$) of the coefficient C_0, thereby generating results $X_0C_{0(0)}$ through $X_0C_{0(k-1)}$. This is repeated for data bits (X_1-X_{M-1}) and corresponding coefficients (C_1-C_{M-1}), respectively. The results are grouped into N groups. Members of each of the N groups are added to one another, thereby generating a first layer of correlation results. The first layer of results is grouped and the members of each group are summed with one another to generate a second layer of results. This process is repeated until a final layer of results is generated. The final layer of results includes a separate correlation output for each possible state of the complete set of coefficients (C_0-C_{M-1}). The final layer of results is compared to identify a most likely code encoded on the data word. The summations can be optimized to exclude summations that would result in invalid combinations of the encoding coefficients (C_0-C_{M-1}). Substantially the same hardware can be utilized for processing in-phase and quadrature phase components of the data word (X_0-X_{M-1}). The coefficients (C_0-C_{M-1}) can represent real numbers and/or complex numbers. The coefficients (C_0-C_{M-1}) can be represented with a single bit or with multiple bits (e.g., magnitude). The coefficients (C_0-C_{M-1}) represent, for example, a cyclic code keying ("CCK") code set substantially in accordance with IEEE 802.11 WLAN standard.